



FINAL REPORT

Livestock Odor Study Committee

January 2008

MEMBERS

Senator Frank Wood, Co-chairperson
Senator Bill Heckroth
Senator David Johnson
Senator John P. "Jack" Kibbie
Senator Paul McKinley

Representative Wes Whitead, Co-chairperson
Representative Jack Drake
Representative Mark Kuhn
Representative Mike May
Representative Dolores Mertz

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Contents:

- I. Committee Proceedings
- II. October 24, 2007, Meeting
- III. November 28, 2007, Meeting
- IV. Committee Discussion and Recommendations
- V. Materials Filed With the Legislative Services Agency

AUTHORIZATION AND APPOINTMENT

The Livestock Odor Study Committee was established by the Legislative Council and charged to "consider issues relating to odors associated with livestock. Study and make recommendations for additional state funding for research into cost-effective management practices, facilities, equipment, and practices to mitigate odor from livestock production facilities, for an Iowa State University Veterinary Laboratory review of airborne disease research, and for research for utilizing manure and other livestock waste products as sources of nutrient recovery and renewable energy."



Livestock Odor Study Committee

I. Committee Proceedings

The Committee was authorized to conduct two meetings during the 2007 Legislative Interim. For the first meeting, the Committee met on Wednesday, October 24, 2007, in the Supreme Court Chamber, Room 103 of the State Capitol. For the second meeting, the Committee met on Wednesday, November 28, 2007, in the Supreme Court Chamber, Room 103 of the State Capitol.

II. October 24, 2007, Meeting

Overview. The Committee adopted rules and elected Senator Wood and Representative Whitead as permanent co-chairpersons. The Committee considered presentations by a panel of professors from Iowa State University (ISU); a panel of managers associated with ethanol production involved in the conversion of manure into bioenergy and biochemicals; a panel of staff from the United States Department of Agriculture; a representative of the Department of Natural Resources (DNR) who is involved in air quality monitoring; and Mr. Bill Northey, Secretary of Agriculture, Department of Agriculture and Land Stewardship (DALs), and Mr. Richard Leopold, Director of the DNR.

A. Iowa State University Panel. The Committee considered presentations by Dr. Steven Hoff, Dr. Jay Harmon, and Dr. Jay Koziel, professors associated with the Department of Agricultural and Biosystems, College of Agriculture and Life Sciences, ISU. They provided a joint presentation regarding research on methods to reduce livestock odor. They discussed sources of livestock odor, including building ventilation, outside storage, and land application.

According to Dr. Hoff, the group's working presumption is that an odor control technology needs to result in at least a 70 percent reduction of source odor when needed (during periods when the atmosphere is stable such as from dusk to dawn). He stated that the ultimate goal is to achieve economically feasible solutions with enough odor reduction to be effective during downwind events. He stated that when determining how to control livestock odor, siting is of paramount consideration.

Dr. Harmon discussed two odor standards based on the ratio of units of air required to dilute one unit of odor, with weak odors measured at a 2:1 ratio and identifiable odors measured at a 7:1 ratio. He discussed a siting model for odor dispersion, referred to as the Community Assessment Model (CAM), that has been used effectively to locate confinement feeding operations in part based on the orientation of buildings and historical weather patterns. He also discussed effective odor mitigation techniques for structures and manure, including biofiltration (resulting in a 60 percent odor reduction), vegetative environmental buffers (e.g., tree plantings), dietary manipulation, covers (permeable and impermeable), and manure injection.

Dr. Koziel described a chemical and sensory analysis of odor. He discussed a number of analytical tools for assessing odor, and methods for isolating chemicals causing odor having the highest impact downwind. According to Dr. Koziel, the compound identified as p-Cresol is a leading component of swine odor. He discussed the potential use of ultraviolet light in reducing odor, but emphasized that basic research is required to evaluate this technology.

In response to questions by Committee members, the panel discussed the complicated nature of the issue, the use of an odor standard, the subjective nature of odor, the use of mitigation



Livestock Odor Study Committee

techniques such as biofilters, and the amount of additional resources and time required to achieve a solution for odor.

B. Bioconversion Companies Panel. The Committee considered testimony from Mr. Don Nelson, Manager and Project Finance Director, Bison Renewable Energy LLC, located at Minneapolis, Minnesota, and Mr. Ted Mathews, Anaerobic Digester/Nutrient Recovery Manager of E3Biofuels, LLC, located at Mead, Nebraska. They discussed the process of obtaining biogas and other chemicals from an anaerobic digester system which is connected with an ethanol production facility and cattle feedlot. They discussed the process of anaerobic digestion, which is a biological process that produces a "biogas" principally composed of 65 percent methane and 35 percent carbon dioxide. Mr. Nelson discussed the Bison's Biogas Regional Anaerobic Digester, "BRAD," being developed in Sioux County, Iowa.

In response to questions by Committee members, Mr. Nelson and Mr. Mathews discussed prices paid for biogas as compared with natural gas, and collection of manure and distribution systems for biogas. Mr. Nelson and Mr. Mathews stated that the market is very competitive and the industry has a promising future.

C. United States Department of Agriculture Panel. The Committee considered presentations by Dr. Brian Kerr, Research Leader, and Dr. Steven Trabue, Research Chemist, Swine Odor Manure Management Research, National Soil Tilth Research Laboratory, Agricultural Research Services, United States Department of Agriculture (USDA). They explained that their research goal is to develop practical technologies resulting in improved gastrointestinal and whole-animal nutrient utilization and a modified microbial ecology (including pathogens) leading to a reduction of the impact of livestock production on the soil, water, and air environment. They emphasized that odor is a complex issue and described a number of analytical methods used to quantify odorants, including the use of human panelists and equipment to isolate chemical components. They identified key odorants in swine manure traceable to dietary inputs, including carbohydrates, fiber, starch and nonstarch polysaccharides, proteins, amino acids, and minerals.

They discussed the relationship between sulfur and odor, noting that distillers dried grains with solubles (DDGS) produced during ethanol production contain large concentrations of sulfur which may impact odor. They also cautioned that while changing dietary rations may reduce odor, it may also affect the quality of the produced commodities, including the composition of the carcass. In response to questions by Committee members, Dr. Kerr and Dr. Trabue discussed the role of sulfur and phosphorus in swine dietary rations, the impact of higher oil content of DDGS upon swine carcass quality, and odor measurement techniques.

D. Department of Natural Resources. The Committee considered a presentation by Dr. Sean Fitzsimmons, Senior Environmental Specialist, Air Quality Bureau, Environmental Protection Division, DNR. According to Dr. Fitzsimmons, a DNR Ambient Air Monitoring Group was established to monitor odor pursuant to Iowa Code section 459.207, in part so the DNR may develop comprehensive plans and programs for the abatement, control, and prevention of airborne pollutants.

He noted that 1,708 odor measurements were taken by environmental specialists in the DNR field offices between 2003 and 2005 using a scentometer, a device that dilutes odorous air with odor-free air to a specified ratio. Dr. Fitzsimmons stated that for purposes of the study, the odor



Livestock Odor Study Committee

threshold at a monitoring location was 7:1 dilution ratio (odor free to ambient air) taken from two readings. He explained that measurements were taken at a fence line for facilities (buildings and manure storage structures) and fields where manure was applied. Other measurements were taken at locations referred to as PERRCs (public use areas, educational institutions, religious institutions, residences, and commercial enterprises). Code section 459.202 provides that a confinement feeding operation structure cannot be constructed or expanded closer than a specified distance from a PERRC.

According to Dr. Fitzsimmons, for measurements at the fence line, the exceedance rate was 7 percent for facilities and 11 percent for manure application. For measurements at a PERRC, the exceedance rate was 4 percent. According to the study, a deep-pit storage had a lower exceedance rate than an uncovered structure used to store liquid manure and the application of liquid manure by injection resulted in a lower exceedance rate than liquid manure applied with later incorporation.

In response to questions by Committee members, Dr. Fitzsimmons discussed the number of exceedances which were measured from a single confinement feeding operation, the lack of consensus regarding an odor standard, the migration of odor plumes which could affect locations based on a number of factors including atmospheric conditions, and the use of mitigation technologies.

E. Secretary Northey and Director Leopold. The Committee considered testimony from Secretary Northey and Director Leopold. Secretary Northey discussed the past history of regulations affecting animal feeding operations, the use of modeling by ISU, and research initiatives which he believes deserve attention, including the use of biofilters, vegetation plantings, and ultraviolet light. Director Leopold discussed both the actual and perceived odor issues which affect producers, and courses of possible action including ISU research projects with participation by producers and organizations representing agricultural producers.

In response to questions by Committee members, Director Leopold discussed the use of the master matrix (Code section 459.305) used to site confinement feeding operations, the willingness of producers to participate in research projects during periods of low market prices, the weather's effect on the storage and application of manure, the frustration of persons who neighbor animal feeding operations, the need to develop practical strategies, and the implementation of demonstration projects.

F. Committee Discussion. Committee members had a wide-ranging discussion about a number of issues, including the number of technologies being developed to mitigate odor; the need to focus upon practical applications of research with proven results; the use of small-scale, on-farm biodigestors; the importance for the state to continue moving forward in developing solutions; the amount of additional resources required by ISU to support its research initiatives; the importance of educating the producers and the public regarding odor; the importance of establishing a timeframe in which to develop proven odor mitigation strategies; the need to establish a state odor standard; the importance of appropriately siting of animal feeding operations; the need to focus upon building design; the need to retrofit existing structures which house animals or store manure; the need to increase funding for the DNR and DALs; and the need for the DNR, DALs, and ISU to continue cooperating.



Livestock Odor Study Committee

III. November 28, 2007, Meeting

Overview. The Committee considered a number of presentations by the heads of the DNR, DALS, and ISU's College of Agriculture and Life Sciences; a panel of professors from ISU who discussed the transmission of diseases in livestock populations; a panel representing a private company who discussed an odor-control product; and a professor from ISU who discussed anaerobic digestion. The Committee discussed proposed recommendations and voted to approve recommendations for inclusion in the Committee's final report.

A. Research Panel — Comprehensive Five-year Plan. The research panel was comprised of Director Leopold; Secretary Northey; and Dr. Wendy Wintersteen, Dean of the College of Agriculture and Life Sciences at ISU.

Director Leopold stated that the panel worked closely to develop a comprehensive plan for mitigating livestock odor referred to as "Taking Odor Mitigation to the Next Level: A Priority for Iowa Agriculture." He discussed improving management practices to increase environmental performance, and the need for cooperation among interested agencies, producers, and producer organizations. Secretary Northey observed how the three members of the panel had coalesced to create a framework for progress. Dr. Wintersteen outlined the plan which involves a five-year comprehensive research strategy by ISU, which would include two tiers of projects.

Tier 1 projects involve proven strategies for on-farm implementation on a statewide basis, including the use of biofilters for swine facilities, the manipulation of animal diets, the installation of vegetative buffers for swine and egg-layer facilities, siting models for swine facilities, and the use of permeable and impermeable covers for manure storage. Tier 2 projects involve unproven but promising strategies that require further research before they can be applied more widely or under specific conditions, including the use of advanced biofilters for swine facilities, the installation of vegetative buffers for beef and dairy facilities, the use of biofilters for egg-layer facilities, the use of wet scrubbers for egg-layer and swine facilities, the development of electrostatic particulate ionization for egg-layers and swine facilities, the use of biocurtains for egg-layer and swine facilities, topical treatments for egg-layer and turkey facilities, and the adaptation of site modeling for livestock other than swine. Dr. Wintersteen also described the research of emerging technologies including the ultraviolet treatment of ventilation air, solid manure injection systems, and the use of floating oil covers on liquid manure. The plan includes mechanisms for the collection of data and the development and distribution of educational programs and materials to assist producers. The total cost for the plan is \$22,783,479.

Committee members expressed appreciation for the panel's work, and discussed a number of issues including possible cost-sharing arrangements, the importance of site selection, and whether a total allocation of \$45,017 in the plan for assisting producers to site swine facilities is adequate, the use of data collected during the research period, how the plan could be integrated with other environmental quality initiatives, and the economic importance of the livestock industry to the state.

B. ISU Panel — Transmission of Animal Diseases. This panel was comprised of Dr. Patrick G. Halbur, Dr. Jeff Zimmerman, and Dr. Rodney "Butch" Baker, professors associated with ISU's College of Veterinary Medicine.

Dr. Halbur, Dr. Zimmerman, and Dr. Baker discussed airborne infectious agents affecting swine populations, including the viral diseases commonly known as Porcine Reproductive and



Livestock Odor Study Committee

Respiratory Syndrome (PRRS) and Swine Influenza. Dr. Zimmerman discussed the objectives of ISU's aerosol research efforts to: (1) develop a body of knowledge regarding transmission, (2) predict events relating to how a disease may be transmitted, and (3) develop intervention or remediation strategies including the removal of threatened animals and the development of technological solutions (e.g., filtration, ultraviolet inactivation, and site placement). An outbreak of Foot and Mouth Disease Virus (FMDV) in European swine farms was cited as an example of how knowledge, prediction, and intervention can be used to control airborne disease.

Dr. Zimmerman noted that there is a minimal understanding of the dynamics of virus-carrying aerosols, but that the airborne transmission of animal disease appears to share many characteristics with the airborne transmission of odor. He described the detection of respiratory pathogens; the effect of temperature, relative humidity, and distance on the stability of airborne infectious agents and infectious diseases; and transmission (shedding and dosing) rates. He recommended a budget of \$277,000 dedicated to PRRS research.

Committee members discussed the importation of feeder pigs into the state and the state's loss of swine farrowing operations due to concerns regarding the transmission of airborne diseases from swine finishing operations. Dr. Baker stressed the importance of adopting simple and sound management practices by producers (e.g., changing clothing prior to entering into a facility). Members also discussed causes for the transmission of animal disease including the design and cleanliness of truck trailers.

C. Agra-Scent GOLD, LLC Panel — Use of Dietary Supplements. This panel was comprised of persons associated with Agra-Scent GOLD, LLC, including Mr. Hal Higgs, an investor, Mr. Dean Kleckner, President, and Dr. Henry Bonnes, Vice President. Mr. Higgs, Mr. Kleckner, and Dr. Bonnes described their business and efforts to eliminate odor by using a dietary supplement referred to as Agra-Scent GOLD™ which is a form of the compound Zeolite. They noted that their product acts at the molecular level to trap ammonia, nitrogen, and other gasses produced inside an animal's digestive tract, and converts its aerosol forms into solids which are accessible by crops. Dr. Bonnes indicated that the product absorbs gasses which have penetrated structures where swine have been kept, and appears to improve animal health (increasing performance and decreasing mortality rates), and the respiratory condition of producers. According to Mr. Kleckner the product is initially fed at a rate of 15-pounds-per-ton of feed and then reduced to five-pounds-per-ton of feed. The panelists stated that tests from several farms indicate that levels of ammonia have been reduced up to 90 percent with continued use. They estimated the cost of the product would range between 70 to 75 cents per head of swine.

Committee members noted that the product appears promising and might replace the need for more costly mitigation techniques. Members discussed the panelists' business marketing strategy. Mr. Kleckner noted that they struggle to convince skeptical producers of the product's effectiveness. In response to questions by Committee members, the panel expressed hope that ISU will conduct a study to determine the product's costs and benefits.

D. ISU — The Current Status of Manure Anaerobic Digestion. Dr. Robert Burns, a professor associated with ISU's College of Agriculture and Life Sciences, discussed the use of manure anaerobic digesters on farms, noting that 73 percent of digesters are associated with dairy operations. Dr. Burns stated that digesters are widely used in Europe on a subsidized basis, but



Livestock Odor Study Committee

historically not in the United States due to the below market return from electricity generation (which is equal to or greater than the retail rate and greater than the wholesale rate), management requirements, and the lack of technical support. He also noted that the profitable use of biogas on farms is contingent on its use and processing ("cleaning"), requiring that it be burned uncleaned for limited uses, or partially cleaned using low-cost methods.

In response to Committee questions, Dr. Burns discussed the economies of scale required to achieve profitability. He noted that a large operation which combines a feedlot and a digester which converts manure into natural gas for use by an ethanol production facility may be commercially viable (see testimony by Mr. Nelson and Mr. Mathews presented during the October 24, 2007, meeting).

IV. Committee Discussion and Recommendations

Committee members discussed a proposal that would apply to persons applying to the Department of Natural Resources (DNR) for a permit to construct a building associated with a swine confinement feeding operation under Code chapter 459. The applicant would be required to complete a Community Air Modeling (CAM) siting study by Iowa State University (ISU). Committee members discussed presentations made by ISU researchers, who indicated that siting is the most important odor control method. Several members expressed concern about whether the proposal was beyond the scope of the Committee's charge, whether the proposal is feasible to implement, and that swine producers should not be targeted for special treatment. Other members supported the proposal, stating that it is based on a proven scientific analysis, siting is a critical factor in mitigating odor, and that it represents a good neighbor policy.

Committee members expressed support for the research proposal developed by ISU, the DNR, and the Department of Agriculture and Land Stewardship (DALs) outlining a five-year comprehensive research plan to mitigate livestock odor.

Committee members adopted two recommendations for consideration by the General Assembly:

- **Community Air Modeling.** That a swine producer required to be issued a permit by the DNR for the construction of a confinement feeding operation (see Code chapter 459), must complete a CAM study conducted by ISU. The results of that study would have to be submitted in a report which would accompany the application and include the location of a proposed building, the configuration of the building and landscape, and other odor mitigation measures to produce the best possible reduction of odors from the confinement feeding operation. The study and report would be nonbinding upon the producer. The state would appropriate up to \$1,000 per study to ISU to cover the costs of performing the study and issuing the report.
- **Research.** That full support be provided to the proposal developed by ISU, the DNR, and DALs, which outlines a five-year comprehensive research plan at a cost of \$22,783,479. As part of the comprehensive plan, ISU must research the use of affordable and benign odor-controlling feed additives, including but not limited to the product referred to as Agra-Scent GOLD™.



V. Materials Filed With the Legislative Services Agency Division

The following materials listed were distributed at or in connection with the Committee's two meetings and are on file with the Legislative Services Agency. The materials may be accessed from the <Additional Information> link on the Committee's Internet web page:

<http://www.legis.state.ia.us/aspx/Committees/Committee.aspx?id=213>

1. Tentative Agenda (11/28/07).
2. Joint Presentation by Agency Heads (Dr. Wendy Wintersteen, Mr. Richard Leopold, and Mr. Bill Northey): Press Release - Voluntary Incentive Program.
3. Joint Presentation by Agency Heads: Taking Odor Mitigation to Next Level: A Priority for Iowa Agriculture (Outline).
4. Joint Presentation by Agency Heads: Taking Odor Mitigation to Next Level: A Priority for Iowa Agriculture Overview of Projects.
5. Joint Presentation by Agency Heads: Taking Odor Mitigation to the Next Level: A Priority for Iowa Agriculture Budget (Revised).
6. Presentation by Dr. Patrick G. Halbur and Dr. Jeff Zimmerman: A Review of Airborne Transmission of Pig Diseases.
7. Presentation by Agra-Scent GOLD(TM) Panel (Mr. Hal Higgs, Mr. Dean Kleckner, and Dr. Henry Bonnes): Business Card.
8. Presentation by Agra-Scent GOLD(TM) Panel: Turning Good Scents Into Dollars (Brochure).
9. Presentation by Agra-Scent GOLD(TM) Panel: Promotional DVD (Available at the Office of the Legislative Services Agency).
10. Presentation by Agra-Scent GOLD(TM) Panel: Ed Wederstein Test Results.
11. Presentation by Agra-Scent GOLD(TM) Panel: Bob Lilienthal Test Results.
12. Presentation by Agra-Scent GOLD(TM) Panel: Tim Bierman Test Results.
13. Presentation by Agra-Scent GOLD(TM) Panel: Max Schmidt Test Results.
14. Presentation by Agra-Scent GOLD(TM) Panel: Burt Brothers Test Results.
15. Presentation by Dr. Robert Burns.
16. An Analysis of Energy Production Costs from Anaerobic Digestion Systems on U.S. Livestock Production Facilities.
17. Tentative Agenda (10/24/07).
18. Background Memorandum prepared by Doug Adkisson, Legislative Services Agency.



Livestock Odor Study Committee

19. Supporting Documents - Results of the Iowa DNR Animal Feeding Operations Odor Study.
20. Supporting Documents - Air Quality Evaluation Downwind from Swine Facilities.
21. Supporting Documents - Denmark Conference Modeling - Hoff & Bundy.
22. Supporting Documents - Partial Biofiltration from a Curtain-Sided Deep-Pit Swine Finisher.
23. Supporting Documents - Mitigating Swine Odor with Strategically Designed Shelterbelts Systems: A Review.
24. Supporting Documents - Classification of Effective Odor Mitigation Techniques - Odors Originating from Housing.
25. Supporting Documents - Gaps in Odor Mitigation Techniques.
26. Adopted Rules.
27. Proposed Rules.
28. Testimony, Dr. Jay Harmon, Dr. Jacek Koziel, Dr. Steve Hoff, ISU (PowerPoint).
29. Testimony, Dr. Don Nelson, Bison Renewable Energy (PowerPoint).
30. Testimony, Mr. Ted Mathews, E3 Biofuels (PowerPoint).
31. Testimony, Dr. Brian Kerr and Dr. Steven Trabue, USDA (PowerPoint).
32. Testimony, Dr. Sean Fitzsimmons, DNR (PowerPoint).
33. Minutes (10/24/07).

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